THE DISCOUNT VERSUS THE COST-OF-PRODUCTION THEORY OF CAPITAL VALUATION

In recent years there has arisen and gained strength in the world of economic theory, a school of writers who find the proximate explanation of interest solely in the preference of individuals for present or early enjoyment over future or later enjoyment. Consistently with this view, these writers find the value of capital to be determined by discounting its future benefits and to have no direct dependence upon the cost-of-production. To every suggestion that interest may be directly determined, in large part, by the productivity of capital, the answer is made that the value of this productive capital is itself arrived at only by discounting, at some rate of interest or time-preference, its future products, and that, therefore, whatever interest is arrived at in the conclusion as due to productivity, was assumed in the premises. So certain is the advocate of the time-preference theory that the productivity theorist must necessarily be thus reasoning in a circle, that no care on the part of the latter to avoid doing so suffices to free him from suspicion of it.

I have myself very lately experienced the effects of this suspicion, as shown in Professor Fetter's criticism, in this REVIEW,[1] of a recent article by me regarding theories of interest.[2] Thus, Professor Fetter says[3] of the article in question:

> The explanation is hardly begun until the productivity is assumed to be a five per cent, a ten per cent, or a twenty per cent productivity. Per cent of what? Of the capital valuation, or the prices at which the borrower can buy the agents. Productivity in what way? In that the present prices, being the discounted value of the incomes that are expected, emerge at their maturing value as time elapses. *The discount-rate involved in the capitalization is the "rate of productivity" which appears again and again in the argument.*

Now I had taken particular pains not to state the rate of productivity as a per cent of capital value, for I knew perfectly well that if I did so I might be accused of reasoning in a circle. To begin with, I had no capitalization and, therefore, no *discount rate* involved in capitalization. In order to avoid all such difficulties, I dealt with *quantities* of goods instead of with *values*,

[1] AMERICAN ECONOMIC REVIEW, March, 1914, in an article on "Interest Theories, Old and New."

[2] "The Marginal Productivity versus the Impatience Theory of Interest," *Quarterly Journal of Economics*, August, 1913.

[3] AMERICAN ECONOMIC REVIEW, March, 1914, p. 90. The italics are mine.

intending to compare the quantity or the number of units of certain goods, which relatively direct production would yield this year, with the quantity of the *same* goods, which exactly the same amount and intensity of this year's labor would yield in a later year if the production process were more roundabout. I assumed that a given amount of productive effort would yield 100 this year by direct production and 110 a year later by a more roundabout method, and then tried to show that the rate at which the present goods would be offered for the future, or vice versa, might be directly determined, at least in part, by this difference in the productivity of the two methods. I did not value either the 100 units of present goods or the 110 units of future goods in terms of money or in terms of anything else exchangeable for them. I did not, at the start, even value either in terms of the other. I simply *asked*, given the assumptions as to direct and roundabout productivity, at what rate the present goods would exchange for the future, and tried to arrive at a conclusion. I had, at one time, myself been a believer in the pure psychological theory, and had thought that the productivity theory necessarily contained somewhere a discount-value assumption, either as to the capital which was said to be productive, or as to the wages of laborers, an assumption which rendered it untenable. I was, in consequence, especially careful, when I came to feel that productivity acts directly, so to state myself as to avoid any semblance of *petitio principii.* I am, therefore, compelled to believe that Professor Fetter's firm conviction of the impossibility of showing interest to depend on productivity, without reasoning in a circle, caused him to take for granted that I had done this, instead of attempting to prove that I had.

It is this same conviction that the productivity theorist must assume a rate of interest to prove one, which has led to Professor Fetter's second misunderstanding of my argument. He says:[4] "Here, as always, the productivity theorist looks at the proximate influence, not at that one step removed; examines the middleman's motive, and ignores the ultimate consumer." And of both Professor Seager and me he says,[5] "their conception of productivity goes little farther than the personal enterpriser."

It is true that in one or two paragraphs of the article which Professor Fetter criticises, I made allusion to the enterpriser who

[4] AMERICAN ECONOMIC REVIEW, March, 1914, p. 90.
[5] *Ibid.*, p. 92.

borrows, and employs labor. This I did in the fear that I might be criticised for dealing with too simple a community and ignoring the complications of modern industry. But, for the most part, I wrote as if assuming a community where each person employed only himself and could engage in roundabout production if he had the accumulated means, where each person might directly borrow of or lend to another, and where each person was at the same time an active producer and an ultimate consumer. If the theory of interest as I presented it in the article in question, has, therefore, any significance at all, it has significance as explaining the fundamental problem, and is not a mere explanation of the relation of middleman-enterpriser's interest to other interest.

Not only do the time-preference theorists explain the value of all capital by the discount process, but they explain cost-of-production in the same way. The expense of hiring labor to construct capital is said to be fixed by the discounted value of the future benefits constructed. The cost of raw material and machinery and, further back, the wages of the labor employed to produce these, likewise depend, directly, only upon the far future benefits to be yielded. The enterpriser, it is asserted, pays for capital and for labor force the discounted value of future benefits and gets the maturing value. Hence, he can afford to borrow and pay interest. But the real interest problem is said to be the problem of valuation of capital and, therefore, of the labor services required to produce capital, at less than the realized future value of the benefits which capital yields.

It is, then, precisely at this point, on the problem of the valuation of capital, that the time-preference theory may be most profitably analyzed. In order to avoid confusing complications and, also, in order to protect ourselves against any possible charge of confining attention to the middleman-enterpriser, let us assume producer and consumer, buyer and seller, employer and employee, lender and borrower, to deal with each other directly.

To picture concretely such a condition of affairs, we may betake ourselves to Crusoe's island after the addition to the island's population of the group of Spaniards. The unimproved land is valueless. It is all "marginal" or "no-rent" land. One acre is as good as another and the supply is more than ample for all who live on the island.

But on part of the land, Crusoe has made valuable improvements. Among other things there are some trees of a certain sort, which

yield nutritious fruit once, a year after being planted, and then die.[6] On an average there are 110 of the fruit to a tree. Young trees, suitable for planting, grow on a neighboring island, as does also the fruit. This other island is not a suitable place for a permanent habitation. But it can be availed of for its products, and can be reached from Crusoe's island, except at high tide, by fording. At first, Crusoe went to the neighboring island, at picking time, for the fruit of these trees. But he soon found that it took him 10 trips to bring over, with considerable effort, 1,000 of the fruit, because of his limited carrying capacity; while 10 trips or, all things considered, an amount of labor equivalent to that required to bring 1,000 of the fruit, would enable him to bring over and plant 10 young trees. The next year these would yield, altogether, 1,100 of the fruit. Conditions of moisture, fertility, etc., are such that the trees have to get their start, as seedlings, on the neighboring island. Hence a new supply has to be secured each year. But, though it involves a year of waiting, the same amount of labor yields Crusoe 10 per cent more by this roundabout method than by the direct.

Enter now one of the Spaniards. Crusoe has just planted his year's crop of 10 trees. The Spaniard, who, in order to accumulate some capital of his own, is doing more work than is necessary to satisfy his present needs, would like to buy. Crusoe demands payment in terms of the kind of fruit the trees yield. One year hence the trees will yield 1,100 of the fruit without appreciable further labor. How much of the fruit are they now worth? How much will the Spaniard give? How little will Crusoe take? Is the question solely one of time-preference with each, or is something else involved in this *valuation of capital?*

We may begin with the Spaniard. His position is analogous to that of a lender. If he buys the trees, he will be giving up present fruit for future fruit. What is the most he will give? He will be guided in his decision by two considerations. *One* of these is his impatience or *time-preference.* The other is the *cost-of-production* (in the place desired) of the trees. If he dislikes to sacrifice present goods for future unless he gets a return of (say) 5 per cent, he certainly will not give 1,100 of the fruit now for 1,100 a year from now. Even after he has gathered enough fruit,

[6] This assumption is made only for simplicity. It is apparent that the principles involved would be no different on the supposition of (say) a thirty-year life and a yield each year after the tenth. But so complicated an illustration of the principle would make the argument more difficult to follow.

from the neighboring island, to buy the trees, he will refuse to buy them at any price above 1,048, and this refusal may be due to his time-preference. But will he give 1,048 if and because his impatience is only 5 per cent? By no means. For he has to deal with the fact that the same number of trips to the neighboring island and the same amount of labor, which will yield him 1,000 pieces of fruit, would get him 10 trees and plant them. If he has to pay Crusoe 1,048 pieces of fruit, he must work harder and make more trips, to get the means of buying the trees from Crusoe, than to get trees directly. He, therefore, however low his rates of time-preference, will refuse to pay more than 1,000 fruit for 10 trees, so long as he can get and plant 10 trees for himself with the same labor as is required to get the 1,000 fruit. His refusal to give more than 1,000 is not due to high time-preference for present goods but to his desire to get future goods in the cheapest way possible. It is not time-preference at all, but a choice between two different amounts of present labor, yielding the same future result. This is the sense in which the value of capital depends upon *cost-of-production.* The value of the trees cannot go above that amount of other goods which requires the same labor to get *directly*, as the trees do. The goods which could be got directly with the same labor and which must be sacrificed for the present if the trees are directly got instead, may be regarded, in an entirely proper sense, as the *cost-of-production* of the trees. The essential fact is, then, that the prospective purchaser of capital has a choice among not less than three lines of action and not between two only. He is not, as the time-preference theorist would have us believe, restricted to a choice between the present fruit and the future fruit. Instead, he can have the present (*i.e.*, the early or this year's) fruit, or he can have next year's fruit from the purchased trees, or he can have next year's fruit from trees which his own labor procures. Not only the preference for present (or early) consumption will cause him to refuse to pay a too high price for Crusoe's trees; but also his other alternative of producing (in the economic sense of producing—in this illustration, place utilities) the trees by his own labor, will cause him to refuse to pay a too high price in the other possible products of such labor. Would Professor Fetter say that this option, the possibility of producing, more directly, the same kind of capital which the Spaniard contemplates buying with other products, exercises no influence *at all*, immediately, on the price in

present goods, which will be paid for durable capital yielding future goods? Would he say that this option can influence capital value only through first influencing time-preference and, therefor, determining a discount rate? Unless he is prepared to make such assertions, his theory of time-preference ceases to be a universal, all-inclusive explanation of capital value.

We reach a parallel conclusion if we suppose that the Spaniard, instead of buying trees of Crusoe the capitalist, employs Crusoe as a laborer to get the trees, paying him in present fruit. The Spaniard will not be willing to pay Crusoe more than 1,000 fruit for the labor of getting or planting 10 trees. Rather than pay wages appreciably higher, he would himself get and plant the trees desired. To be an employer of labor, advancing present consumable goods for durable capital, he must produce present goods in excess of his own present needs. *But he has the alternative of devoting his surplus time, instead, to the production of durable capital which will serve his future needs.* This possible alternative will make him unwilling, however low his time-preference, to accumulate present goods for the payment of wages, unless his future return from so doing is equally large.

Likewise, if we suppose him to lend to Crusoe, the rate at which he will lend is influenced *directly* by his other alternative, and not merely by his time-preference or by his other alternative acting through the intermediation of time-preference. He will not lend Crusoe 1,000 fruit this year for much less than 1,100 next year, however low may be his time-preference, because the labor necessary to secure him the surplus 1,000 this year above present needs will, if turned to more roundabout production, yield him a return next year of 1,100. He would rather get 1,100 next year as a result of this year's labor in roundabout production, than to get *less* than 1,100 next year as a result of this year's labor in supplying Crusoe's present needs. There is no intention to deny that the surplus productivity of roundabout production also influences time-preference, by influencing the relative endowments of present and future.[7] Neither is there any intention to deny that the rate of time-preference, by influencing the extent to which roundabout production is carried, affects the marginal gain from such production. In the article[8] which Professor Fetter criticises, I distinctly asserted both of these facts. The rate of

[7] See Böhm-Bawerk, *Positive Theorie des Kapitales,* Dritte Auflage (Innsbruck, 1912), p. 468.

[8] *Quarterly Journal of Economics,* August, 1913.

interest fixed by market competition will also be the rate of time-preference and the rate of surplus productivity of roundabout production. But to assert this is not to assert that time-preference is the sole proximate cause and that all other causes must act through it. As we have just seen, the rate of productivity influences *directly* the supplier of present goods; and the cost-of-production of capital, in the sense here used, has a *direct* influence on the demander of such capital.

Suppose, now, we turn to Crusoe's side of the market, the side of the person who purchases present goods with future. What determines the price at which Crusoe will dispose of his 10 trees, or rather, since this is the important question in the long run for capital valuation, at what price in present fruit will Crusoe be willing to engage in the business of getting, planting, and selling trees? Crusoe, we may suppose, is now permanently on the present goods side of the market. He is no longer accumulating capital and has, perhaps, lost or dissipated what he had. If he produces durable capital, it is only to dispose of it for present consumable goods. Let it be understood that we are not assuming Crusoe to be a middleman. On the contrary, he is here the "ultimate consumer." But he is also a producer. He wants present goods, present fruit. To get this fruit, he must either go to the neighboring island and bring it over *or* he must buy it of somebody else by offering future goods. Once he has produced these future goods, *i.e.*, secured and planted the 10 trees, time-preference may alone decide at what rate he will exchange them for present fruit. But *before he turns his labor in that direction,* he will consider whether he can get more present fruit by producing durable capital to buy it with or by devoting the same labor to getting the present fruit. Year in and year out Crusoe will not maintain the supply of more durable capital, *i.e.*, will not produce it for sale, except at a price which is as satisfactory to him as the yield of direct production of present goods. The labor necessary to get the 10 trees is the same, on our hypothesis, as the labor necessary to get 1,000 pieces of the fruit. The 10 trees, planted near by, will yield next year 1,100 pieces of fruit.

Crusoe's rate of time-preference of course fixes a minimum below which he will not sell the trees. If his rate of time-preference is 15 per cent, he will not sell them for less than 956 fruit, because he would rather wait for the 1,100 future fruit. But, in the long run, his minimum price is fixed by *two* considerations and not by

one only. The second consideration is his alternative of directly producing the fruit by going to the neighboring island after it. Year in and year out, he will not bring, plant, and sell the trees for less than 1,000 of the fruit. If he cannot secure approximately that price for the trees, he will get the fruit directly instead of trading for it. The possibility of his doing so will itself tend to keep the trees scarce enough to yield that price in terms of the fruit. In other words, he will not sell the trees for less than their cost-of-production measured by the other goods which the same work would produce.

Our conclusion is no different if we assume him to sell his services as a laborer, for wages, instead of selling the trees. He will not work for the Spaniard at the job of getting and planting trees, for a less wage in present fruit than the amount of present fruit which the same labor would give him if applied directly to bringing the fruit from the other island.

But instead of selling trees for present fruit or working for wages in present fruit, Crusoe may borrow present fruit to pay it back next year. Here, also, if he is a *productive* borrower, he is not simply comparing present and future benefits. If he has no accumulations and if, also, it requires all his present labor to provide for his present needs, Crusoe must needs engage in direct production unless he can borrow. If he can borrow 1,000 present fruit, he is relieved from the necessity of getting fruit now for present needs and can get the trees instead. But more than 1,100 fruit next year for 1,000 fruit this year, he will not give, since the former represents *more present labor than the latter.* Only an unproductive borrower would make such a contract and he would soon be eliminated from the market. On the other hand, however low might be his time-preference, Crusoe would still be willing to borrow at any rate of interest less than 10 per cent. To do so would leave him as well off in the present and better off in the future. He would borrow at less than 10 per cent because to do so would give him a larger future income than not to do so. His comparison would be *between two futures, rather than between a present and a future.*

In this discussion, no middlemen, banks, etc., have been assumed. Trade has been supposed to take place in kind. The producer of present goods desired future goods; and the producer of future goods desired present goods. There was specialization and trade. In spite of the assumed absence of complicating fac-

tors, it is believed that the essential elements of the problem have been included. The discount theorist can hardly expect to strengthen his case by making its truth depend upon the number of middlemen coming between the ultimate parties concerned, or upon the use of money, or upon the intermediation of banking.

Let us now turn to the distinction between land and capital, regarding which Professor Fetter has, again, greatly misunderstood my previous article. The distinction is not, strictly, one between land and all other capital. It is a distinction rather between reproducible and non-reproducible goods. The paintings of old masters and business sites in New York City are in the same category. For all practical purposes, they cannot be reproduced. I am not at all arguing that there is no "made land" or that land owes none of its value to work upon it. But so far as its characteristics cannot be reproduced, the value of land is not limited by its cost-of-production. Crusoe could not sell his 10 trees for more than 1,000 pieces of fruit, for that was their equivalent or their cost-of-production. But if the island were crowded, and there were no practical possibility of adding to the land, no such definite limit would determine a minimum price of the land in terms of other goods. The value of this land could be arrived at only by discounting the prospective value of its future yield. The value of reproducible capital is influenced by *two* considerations; that of capital *not* reproducible, by *one*. Whatever Professor Fetter believes about land or sites as being similar to or different from other capital, he probably would not deny that some capital—land, old paintings, original Greek statuary, etc., is not reproducible in quite the sense to the buyer, that houses, factories, trees, etc., are. His theory of valuation (except that the rate of surplus productivity of roundabout production influences even this discount rate) may serve to explain the value of such capital as land. But it never has been shown and cannot be shown that the value of reproducible capital has not as one of its determinants, the cost of its production, in the sense here explained.

I have tried, in this paper, to meet the issue presented by Professor Fetter as squarely as possible by showing just what cost-of-production properly means when it is said that the value of capital depends upon it. Undoubtedly, productivity theorists have been careless in this regard and have, by incomplete analysis, laid themselves open to the charge of taking as cost-of-production something

that itself involved discounting. But it is not necessary to do so. I do not claim any originality of view in thus defending a theory long since held, however incompletely stated, by many economists. Whether for good or ill, a large part of scientific discussion in every age has to be devoted to reëstablishing in current thought correct doctrines elaborated by earlier thinkers, but questioned by a few writers of a later date. All possible lines of attack, even if capable of being easily repulsed, cannot possibly be anticipated. Consequently, new and ever more intricate processes of reasoning are invoked against supposedly established principles, attacking them at points where the forces of defense have not previously been compelled to rally. Of such a nature is the attack upon the productivity-theory of interest and the cost-of-production theory of capital. The earlier economists generally believed that the value of capital depends, in large part, directly on its cost of production. This seemed obvious to them as it probably does to most economists today. They did not foresee that attempts would later be made to analyze all costs of production into the discounted value of future services. Hence they did not forestall these attempts. Since these attempts have been made, however, and by economists of note, it becomes important to show that cost-of-production cannot be entirely disposed of as a concept arrived at by first assuming a rate of interest. When this has been shown, even the so-called crude or naïve productivity theorist, who says that interest is a certain per cent because capital of a certain value yields a certain return, is seen to have been, however incomplete his analysis, less fundamentally in error than is sometimes believed.

Professor Fetter ventures to suggest that my treatment of interest is "eclectic,"[9] because I do not see the explanation of interest in one cause. If to admit that interest is affected both by time-preference and by productivity, is to be eclectic, I can hardly object to the application of the term. Surely there is no special virtue and no special consistency in holding that a given phenomenon is explainable by a single cause instead of by two or more causes.

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[9] AMERICAN ECONOMIC REVIEW, March, 1914, p. 92.